tion is a violent poison because of its arsenic content and although tobacco leaves contain nicotine which when in solution is an effective parasiticide, yet these agents in their dry state do not destroy mites.

Duplicate tests were run with naphthalene or powdered moth balls which on account of its volatile substances emitted, killed all mites in the tests in 45 minutes.

Insect powder containing gasoline and crude carbolic acid, on account of the volatile substances given off, killed all mites in one minute.

In duplicate tests, solutions sufficiently concentrated killed in the following lengths of time: Crude carbolic acid, 20 seconds. Five per cent. carbolic acid, one minute. One per cent. naphthalene in kerosene, 30 seconds. One per cent. kreso dip ten minutes and two per cent. four minutes. Ten per cent. formaldehyde ten minutes.

Conclusions

In order that parasiticides be effective in the destruction of the mites they must either be in solution or be capable of giving off volatile substances which in themselves are destructive.

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THE GROWTH OF BONE IN CRETACEOUS TIMES

PALEONTOLOGISTS have, for many years, been acquainted with the curious conical portions of young plesiosaurian propodials and, also, they have observed definite openings on the edges of many of the flattened limb bones. One of these openings has, in some cases, been observed to lead into a canal, which, in turn, passes into a cavity, remarkably like the medullary canal of mammalian long bones. There has never been an adequate explanation for these curious conditions.

It has been generally assumed that the unusual characters mentioned above have been confined to the propodium (humerus or femur) but, recently, in studying the osteology of an immature plesiosaur from the Cretaceous, the writer noted all of these characters in a phalangeal bone. Further study of this problem will doubtless result in the discovery of these characteristics in all the long bones of the skeleton, especially in young and immature animals.

Andrews, Williston, Lydekker, Kiprijanoff and the writer have remarked on the unusual characters of this ancient group of aquatic reptiles and an attempted explanation[1] has been given of the curious conical ends of young propodials which formerly were regarded as epiphyses.

In regard to the openings, canal and cavity, the writer believes an adequate explanation of this condition is to be found in the developmental history of the mammalian long bones. Szymonowicz[2] has figured in a developing long bone of a mammal an opening which he terms "periosteal bud," similar in all respects to the opening in the edge of plesiosaurian limb bones. In both cases a canal leads from the foramen into the medullary cavity.

Jackson[3] has given a careful description and figure of a similar condition in the tibia of a three-day cat. Through this opening the blood vessels supplying the medullary cavity, the osteoblasts and marrow-forming elements migrate from the periphery into the medullary cavity.

Bidder[4] has further studied the conditions of bone formation and his contribution has suggested an explanation for certain curious features in the propodials of the plesiosaurs. The question arises as to whether it is legitimate to interpret developmental factors in the ancient reptiles from what occurs in modern mammals. That question is not yet settled, but assuming that an analogy may be safely drawn between developmental features in the

[1] Moodie, Roy L., "Reptilian Epiphyses," *Amer. Jour. Anat.*, Vol. 7, No. 4, pp. 443–467, Figs. 1–24, 1908.

[2] Szymonowicz, L., "A Text-book of Histology and Microscopic Anatomy of the Human Body," trans. by MacCallum, 1902, p. 270, Plate XXIX.

[3] Jackson, C. M., *Archiv für Anat. u. Physiol., Anat. Abth., Jahrg.*, 1904, p. 33, Taf. VII., Fig. 1.

[4] Bidder, Alfred, 1906, "Osteobiologie," *Archiv f. mikros. Anat.*, Bd. 68, pp. 137–210, Taf. X–XIV.

two groups we may use the facts, in the works above referred to, to explain conditions in the Cretaceous plesiosaurs which are inexplicable on any other grounds.

The limb bones of adult plesiosaurs are solid. Young bones nearly always exhibit the canal, cavity and one or more of the foramina above referred to. The fact that the bones are first hollow and later become solid would seem to indicate that the osteolytic elements present in the limb bones of mammals and most reptiles were almost absent, or present in small numbers, in the plesiosaurs and many of the larger dinosaurs.

If the comparison between the developing limb bones of mammals and reptiles is a safe one, then we have here in the young aquatic plesiosaurs of the Cretaceous a condition which persisted until late in life and which recurs in the young of all mammals at the present day. One species of plesiosaur, based on an immature skeleton of an animal some fifteen feet in length, exhibits these conditions in a well-marked manner. Through the openings in the edges of the limb bones of the plesiosaurs, as in the mammals, migrated the osteoblasts or bone-forming cells, the blood vessels and other elements.

The peripheral or perichondral bone was formed first in the plesiosaurs as in the modern mammals, and, through the migration of the bone-forming cells inward, the so-called endochondral bone was a secondary formation. The formation of bone within the endochondrium of the plesiosaurs was, apparently, retarded by some osteolytic agent, possibly the osteoclasts, until the bone-forming elements for some unknown reason attained the supremacy and completely filled the medullary cavity, canal and foramen with solid bone. During this process of filling there resulted, in young bones, a sharp line of separation of the perichondral from endochondral bone, resulting in the formation of curious conical end pieces, formerly called epiphyses, but now known to be the result of bone growth and not epiphyses at all.

Bidder[4] has offered an interesting explanation of the formation of epiphyses in mammals, by the migration of the osteoblasts through special vascular canals (*Canalis vasculosis perforans*) which traverse the space between the medullary cavity and the cartilaginous caps at the ends of the limb bones.

It is interesting to observe in broken and sectioned plesiosaurian propodials an exactly similar condition for this ancient group of aquatic reptiles. The canals are found extending from the medullary cavity to the ends where the bone has been formed in the shape of small conical mounds around the vascular openings, so that in the plesiosaurs the process resulted not in the production of new growths at the ends of the limb bones (epiphyses) but in the elongation of the bone. It is hoped in another place to give a fuller explanation and figures of these interesting relics of Mesozoic osteogenesis.

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THE COLUMBUS MEETING OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

The regular meeting just held at Columbus (December 27 to January 1) was one of the most successful of the recent meetings of the association. All of the sessions were held in the buildings on the campus of the Ohio State University and members of the association who attended the Columbus meeting of 1899, and who had not visited the university since were surprised and delighted at the enormous growth of the institution and at the character of the many new buildings which had been built since that day. The local committee in charge of the arrangements was extremely efficient and the compactness of the group of buildings and the exceptional meeting room facilities made everything easy for members in attendance.

The opening night for addresses of welcome and for the annual address of the retiring president was in many respects the most impressive function of the kind held under the auspices of the association in the recollection of the writer. In spite of a stormy night the college chapel, seating about 1,200 persons, was completely filled. The address of welcome by President W. O.